form a stage in the growth of the gland. In the mature state of the organ in this animal I consider that the vesicles, as usually supposed, consist of cavities more or less spherical in shape, which are not in communication with one another.

The points mentioned in this note, together with others connected with the subject, will be fully discussed in a future paper.

II. "On Stratified Discharges. V. Discharge from a Condenser of Large Capacity." By WILLIAM SPOTTISWOODE, M.A., LL.D., Treas. and V.P.R.S. Received November 22, 1877.

The principal object of the following communication is to describe an instrumental arrangement which has proved very convenient for the production of steady striæ. The first attempt which was made nearly two years ago (February, 1876), consisted in charging a Leyden battery of nine large jars by means of an induction coil, and discharging it gradually through a vacuum tube. This was effected by connecting one terminal of the tube with the outside of the battery, and presenting the other terminal, made pointed, to a knob connected with the inside, at suitable distances. The following effects were then observed:

(1.) When the interval between the terminal and the knob was considerably greater than striking distance, the appearance in the tube was cloudy and apparently unstratified, or showed only faint indications of stratification. It was, in fact, very similar to that produced by attaching one terminal of the tube to one of an induction coil, and carrying the other to the earth.

(2.) When the interval was within striking distance, the usual jar-discharge without stratification or dark space took place.

(3.) When the interval was slightly greater than striking distance, but not so great as in the first case, a bright stratified discharge was observed. The proper motion due to a decline in tension was shown by a revolving mirror, and by a careful but rapid alteration in the distance during discharge, the motion could be arrested or even reversed. The duration of the whole, although long compared with a single flash from an ordinary coil, did not exceed half a second.

This experiment gave reason to hope that if a condenser of sufficient capacity were constructed, the discharge might be prolonged, and even varied, so as to allow an actual study of its various phases to be made.

The next attempt was made during last summer with some condensing plates, constructed for cable purposes, and kindly lent to me by Messrs. Latimer Clark, Muirhead, and Co. The results were in every way calculated to encourage further steps.

At the suggestion of Mr. De la Rue, and with the assistance of his

battery for the purpose of testing the instrument, the same firm constructed for me condensers of which the following are the particulars. Each condenser is contained in a box, and has a capacity of 13·8 micro-farads, subdivided into ten sections, each section containing forty sheets of tinfoil, 18 in. × 13 in., insulated from each other by eight sheets of parafined tissue paper. The superficial area of foil in each box is 1,300 square feet, and that of parafined paper 14,166 square feet. It was found that these condensers could easily be charged with a 4-inch induction coil, worked by two Grove's, or even bi-chromate, cells. A much smaller coil would certainly suffice if the coil were made with a thick secondary, since $\frac{1}{4}$- to $\frac{1}{2}$-inch sparks are all that are required. In order to charge the condenser, one terminal of the coil was carried to outside of the condenser, and the other to the other with an intervening air spark. The object of the air spark was twofold: first to ensure that the tension of the electricity was sufficient to give the required charge to the condenser, and, secondly, to prevent the latter from discharging itself back through the secondary of the coil. After some trials, it was found that the air spark might, with great advantage in steadiness of action, be replaced by a vacuum-tube which offered sufficient resistance: such, for instance, may generally be found among those prepared for spectrum analysis, although these differ very widely in resistance. Lastly, the condenser was furnished with a safety discharger, consisting of a brass sphere and a point adjustable in distance from one another, so that the condenser might discharge itself at a suitable tension; *i.e.*, before the tension rose high enough to break down the insulation of the plates.

The discharge through the vacuum tubes on which experiments were being made was effected either by leading the two sides of the condenser directly to the terminals of the tube; or more often by leading one direct, and the other through the intervention of a resistance coil, such as was described in the Proceedings of the Royal Society for 1875, pp. 461—2. By altering the length of the resisting column as the tension in the condenser declined, the charge could be delivered through the tube at any required rate.

By this arrangement a steady stratified discharge can be maintained for one, two, or more minutes, according to the nature and pressure of the gas contained in the tube. In one case, with a nitrogen tube of 30 inches in length and 2 in diameter, a special fixed phase was maintained for upwards of five minutes with one of the boxes above mentioned.

Speaking in general terms, the same connexion between resistance in the circuit and the flow of the striæ as had previously been noticed with the induction coil and rapid contact-breaker (Proceedings of the Royal Society for 1875, pp. 458—9) was observed with this method; but the phenomena were exhibited with greater distinctness, and could be examined more at leisure.

In particular, with the nitrogen tube above mentioned, and other similar tubes, the direction of the flow reversed itself as the charge in the condenser became more exhausted. This was apparently due rather to a diminution in strength of current, or quantity of electricity passing through the tube, than to fall in tension, inasmuch as any particular phase could be maintained by gradually diminishing the resistance in the circuit as the tension declined. The penultimate phase was a forward flow from the positive terminal, the ultimate a fixed condition of striæ. When sufficient resistance was interposed in the circuit, these striæ showed a faint indication of fissure into pairs of laminæ, and even actually broke into pairs by forward jerks. Very shortly after this the column became blurred, and the discharge then finally ceased. It should be further mentioned that by a suitable increase or diminution of resistance in the circuit the flow could be reversed again and again at pleasure.

It has frequently been noticed that in some tubes the column of striæ shows a tendency to mobility, while in others it is comparatively fixed; in one case it appears to be in a position of unstable, in the other in a condition of stable, equilibrium. The former may generally be exemplified in hydrogen and nitrogen vacua, the latter in carbonic acid, hydrochloric acid, and other vacua. Experiments which I have recently made with another, in some respects yet more powerful, method, tend to bring out the connexion between these two classes, but I reserve an account of them for a future occasion.

Pursuing this subject further, I repeated the same experiments with an 18-inch, instead of a 4-inch coil, using as a battery either six large bichromate of potash cells, or, with still better effect, a large Gramme's machine, worked by steam. The results were in every way satisfactory. Tubes in which with the 4-inch coil the striæ were at best only imperfectly developed, or in which it was impossible to maintain the discharge for any appreciable time, were illuminated successfully in both respects; and in many cases the supply of electricity from the coil to the condenser could be so regulated as to maintain special phases for an indefinite time. The change of tint from pale salmon colour to violet-gray in (impure?) carbonic acid vacua, due to increased tension, as observed by Mr. De la Rue with his great battery, were here displayed with great brilliancy.

The advantage of the 18-inch over the 4-inch coil consisted not so much in the tension as in the quantity of electricity given off to the condenser at each secondary discharge; and it seems probable that a coil specially constructed with very thick primary and secondary, and capable of giving sparks from $\frac{1}{4}$ to $\frac{1}{2}$ inch in length, would be the most suitable instrument for the purpose. It would, of course, be necessary that the condenser should have sufficient capacity to act as a fly-wheel during the intermittence of the supply from the coil.